

## Draft SWMU 2B, 2C, and 2E Feasibility Study Addendum: Reassessment of Remedial Alternatives

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### Purpose

The *Final Feasibility Study (FS) for Solid Waste Management Units (SWMUs) 2B, 2C, and 2E*, located at the Naval Air Station (NAS) Oceana in Virginia Beach, Virginia was completed in March 2002. Remedial Alternatives developed as part of this FS were based on existing site conditions at the time the FS was completed. However, at the March 2004 NAS Oceana Project Management Team (NASO-PMT) meeting, the team agreed to conduct treatability studies at these three SWMUs in order to evaluate the effectiveness of competing biodegradation agents for treating groundwater CVOC contamination. These treatability studies were conducted in August-September 2004. As a result of these response actions, site conditions upon which the remedial alternatives in the original FS were based have changed. Therefore, this technical memorandum presents an updated development and comparison of remedial alternatives based on the post-treatability study monitoring results.

### Development of Remedial Alternatives

The site-specific remedial action objective (RAO) for each of these three sites developed in Section 2.2 of the FS was to:

- Prevent exposure to unacceptable risks to potential human receptors of groundwater

This section discusses the updated remedial alternatives developed to address the RAOs for contamination present at SWMUs 2B, 2C, and 2E.

### General Response Actions

General response actions are broad classes of responses, remedies, or technologies developed to meet site specific RAOs. Each general response action is intended to address specific contaminants and the possible migration pathways and exposure routes in each environmental medium. Although an action may be capable of meeting the objective for a given medium, combinations of actions may later prove to be more cost effective in meeting

all of the objectives for the site. Therefore, to comply with the site RAOs, the general response actions are normally combined to form site-wide remedial alternatives.

The revised general response actions listed below and shown on Table 1 have been identified for the remediation of SWMUs 2B, 2C, and 2E:

- No action
- Institutional Controls
- Monitoring Actions

Under the *no-action response*, the current site conditions at each SWMU would remain.

*Institutional control actions* consist of a number of alternatives that can be used singly or as a part of a site-wide remedial alternative. Institutional controls include such activities as applying restrictions to groundwater use. Access restrictions can be effective as a means of preventing exposure to the groundwater.

*Monitoring actions* include long-term monitoring (LTM), monitoring active remediation (MAR), or monitoring natural attenuation (MNA). LTM consists of tracking groundwater quality and the potential for offsite plume migration. Monitoring remediation or attenuation of contaminants could also be evaluated by collecting groundwater samples to monitor contaminant trends.

## **Identification and Screening of Remedial Alternatives**

Revised remedial alternatives were identified which could meet the RAOs for each SWMU. These alternatives were then screened using site-specific information from previous investigations and information regarding the probable efficacy of the treatability studies.

### **No Action**

The no action response is retained as a baseline for evaluating remedial alternatives.

### **Institutional Controls**

The institutional control retained during the screening process was groundwater-use restrictions, which can be effective as a means of preventing exposure to the groundwater. The effectiveness of restrictions depends of continued use and the ability to enforce them.

### **Monitored Natural Attenuation**

The monitoring action that was retained for SWMUs 2B, 2C, and 2E during the screening process was monitored natural attenuation (MNA). Groundwater monitoring can be protective of human health by tracking changes in the extent of contamination and groundwater quality. Evidence of MNA prior to implementation of the treatability studies and reagents injected into the groundwater to enhance biodegradation as part of the treatability studies are likely to result in improved groundwater quality over time.

## **Remedial Alternatives for Groundwater at SWMUs 2B, 2C, and 2E**

Remedial alternatives were revised based on the anticipated success of the recent treatability studies at the three SWMUs. Two remedial alternatives were developed for groundwater at SWMUs 2B, 2C and 2E on the basis of the general response actions previously discussed in this section.

### **Site-specific Remedial Action Objectives**

The site specific RAOs identified for SWMUs 2B, 2C, and 2E are to:

- Prevent exposure to unacceptable risks to human receptors of groundwater

#### **SWMU 2B**

Concentrations of arsenic, iron, and manganese are present in SWMU 2B groundwater and can pose risks to human health under a residential scenario. Previously, concentrations of TCE, cis-1,2 DCE, and VC were present in SWMU 2B groundwater at concentrations that could pose a risk to human health if groundwater was used as a potable drinking water supply. However, based on the most recent rounds of sampling in July and November 2004, concentrations of TCE, cis-1,2 DCE, and VC have been reduced below the MCL screening criteria for these constituents. If concentrations of contaminants remain below MCLs in future rounds of sampling, compliance with ARARs will have been achieved. However, the arsenic, iron, and manganese detected at SWMU 2B contributing to unacceptable risks in the HHRA are not considered to be site-related contaminants.

#### **SWMU 2C**

Concentrations of TCE, cis-1,2 DCE, VC, arsenic, iron, and manganese are present in SWMU 2C groundwater and can pose risks to human health under a residential scenario. Similarly, concentrations of VC, arsenic, iron, and manganese in SWMU 2E groundwater can pose a risk to human health if groundwater is used as a potable drinking water supply. However, the arsenic, iron, and manganese detected at SWMU 2C contributing to unacceptable risks in the HHRA are not considered to be site-related contaminants.

#### **SWMU 2E**

The HHRA indicates that exposure to the groundwater in SWMU 2E poses a risk due to the presence of inorganic and fuel related products, which are specifically exempted from CERCLA actions. However, VC has been detected at one location at a concentration, which poses unacceptable risk to human health under a residential scenario.

## **Remedial Alternatives**

Remedial alternatives were revised for SWMUs 2B, 2C, and 2E on the basis of the general response actions, the results of screening of remedial technologies, and the anticipated

success of the *in-situ* treatability studies implemented at the SWMUs. The alternatives identified for evaluation include the following:

- Alternative 1 – No Action
- Alternative 2 – Institutional Controls and Monitored Natural Attenuation

The major components of each remedial alternative are defined in the following subsections.

#### **Alternative 1 – No Action**

The no-action alternative is required by the NCP and serves as the baseline alternative. All other remedial action alternatives are judged against the no-action alternative. Under this alternative, the response actions completed as part of the SWMU treatability studies would most likely continue to improve groundwater quality, but no monitoring would be completed to determine the efficacy of the treatments. However, since groundwater contamination is still present at concentrations exceeding MCLs, the site would be reviewed every five years in accordance with (Section 12(c) of the NCP), as amended by SARA (1986). The five year review would include one round of monitoring.

#### **Alternative 2 – Institutional Controls and Monitored Natural Attenuation**

Alternative 2 consists of institutional controls (groundwater-use restrictions) with MNA to track changes in groundwater quality. The major components of this alternative are:

- Institutional controls  
Institutional controls at SWMUs 2B, 2C, and 2E would include restrictions on groundwater extraction for potable use within the site boundaries, downgradient of the site, and within some distance of the site boundaries (yet to be determined).
- Monitored Natural Attenuation (MNA) – Sampling data indicates that biodegradation of CVOCs in groundwater through reductive dechlorination and cometabolism is occurring at SWMUs 2B, 2C, and 2E. Additionally, the treatability studies recently implemented at these SWMUs are designed to enhance natural attenuation processes. MNA of the groundwater at SWMUs 2B, 2C, and 2E would involve groundwater sampling consisting of two additional rounds of post-injection monitoring to be completed in May and September 2005 (as part of the planned post-treatability study monitoring), and annual monitoring until site specific RAOs have been achieved.

## **Detailed Analysis of Remedial Alternatives**

The remedial alternatives which were developed in the previous section are evaluated in detail in Table 2. The National Contingency Plan (NCP) requires that the remedial alternatives be evaluated against the nine criteria listed below, as defined in the NCP. A detailed description of these criteria is included in Section 4.0 of the Final FS for SWMUs 2B, 2C, and 2E. The first seven criteria are reevaluated in this addendum. The last two criteria will be addressed in the Decision Document (DD). The nine criteria are:

- Protection of Human Health and the Environment
- Compliance with applicable or relevant and appropriate requirements (ARARs)

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, and volume
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

## Comparative Analysis and Recommended Alternatives

The updated comparative analysis of proposed remedial alternatives and the recommended remedial alternative for groundwater at SWMUs 2B, 2C, and 2E are documented in this section.

### Comparative Analysis

The conclusions of the HHRA determined that there is an unacceptable risk to potential future residential receptors at the site from potable use of groundwater from the water table aquifer at SWMUs 2B, 2C, and 2E. However, recent treatability studies have been implemented at these SWMUs in order to eliminate risk to human receptors. In the following analysis, the sitewide remedial alternatives are evaluated in relation to one another based on each of the seven NCP criteria discussed in the previous section. The purpose of this analysis is to identify the relative advantages and disadvantages of each alternative. The comparative analysis will focus on factors that provide distinctions between the alternatives.

The site specific RAOs for these SWMUs are to:

- Prevent exposure to unacceptable risks to potential human receptors of groundwater

The alternatives evaluated for SWMUs 2B, 2C, and 2E are:

- Alternative 1 – No Action
- Alternative 2 – Monitored Natural Attenuation and Land Use Controls

Table 2 provides a comprehensive evaluation of each alternative and provides the required comparative analysis for the seven NCP criteria which can be evaluated at this time following the CERCLA process.

Based on the findings of the HHRA, the current site conditions at SWMUs 2B, 2C, and 2E present a potential risk from potable use of groundwater at these SWMUs. The institutional controls in Alternative 2 guard against future risk of potable use of the groundwater. As a result of the response actions implemented at these SWMUs, enhanced biodegradation of contaminants is likely to be occurring at these SWMUs. Additionally, sampling data collected prior to the implementation of the treatability studies indicated that natural attenuation was occurring at these three SWMUs. Enhanced biodegradation of contaminants and natural attenuation may reduce contamination levels to within ARARs before the end of the post-injection monitoring period.

Alternative 1 is not protective of human health, as no action is taken against exposure to contaminated groundwater. The groundwater use restrictions under Alternative 2 prevent the use of groundwater at these SWMUs as a potable drinking water supply until such time that the site-specific RAOs are achieved. Therefore, the potential drinking water ARARs would be met.

Both alternatives comply with the location-specific and action specific ARARs.

The present-worth cost of Alternative 1 including 1-round of monitoring at the five-year review point is \$15,721.00. The present-worth cost of Alternative 2 including three additional rounds of monitoring in May 2005, September 2005, and May 2006 is \$55,385.00. Assumptions associated with the present-worth calculations include a discount rate of 3.5% (OMB Circular No. A-94, Appendix C). The cost estimates presented are provided to an accuracy of +50 percent to -30 percent. Alternative cost estimates are in 2005 dollars and are based on conceptual design from information available at the time of this addendum. The actual cost of the project would depend on the final scope of the selected remedial action, the schedule of implementation, competitive market conditions and other variables. If contaminant concentrations are not reduced to within ARARs within three sampling rounds presented as Alternative 2, or, if additional 5-year reviews are needed under Alternative 1, it is possible that additional sampling may be needed.

### **Recommended Alternative**

Alternative 2, Monitored Natural Attenuation and Land Use Controls is the recommended alternative because it has the likelihood of meeting the RAO, meets the ARARs, and guards against future risk. Alternative 1 does not meet the RAO and ARARs and does not provide for long-term groundwater quality tracking or guard against future risk.

The implementation of the MNA program and groundwater use restrictions under Alternative 2 would continue until such time that the site-specific RAOs are achieved at each specific SWMU. Once the RAOs (and ARARs) have been achieved at a specific SWMU, with concurrence from the NASO-PMT, the MNA program and groundwater use restrictions at that SWMU would be discontinued and no further response action under CERCLA would be required.

**Table 1**

**Identification and Screening of Remedial Technologies for Groundwater at SWMUs 2B, 2C, and 2E**

General Response Action	Remediation or Technology	Process Options	Description	Screening Action		Screening Comments
				Retain	Reject	
No action	None	Not applicable	No action	X		Retain as baseline alternative
Institutional Controls	Administrative groundwater-use restrictions	Deed restrictions	Property in the area would include groundwater-use restrictions	X		Potentially applicable if implemented in conjunction with other process options.
Monitoring	Monitoring Groundwater	Long-term groundwater monitoring	Monitoring of contamination to track groundwater quality, and to monitor the potential for offsite migration.	X		Technically feasible.

**Table 2**  
**Analysis of Remedial Alternatives for Groundwater at SWMUs 2B, 2C, and 2E**

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Institutional Controls with MNA Institutional Controls with MNA
<b>Overall Protection of Human Health and Environment</b>		
Prevention of unacceptable risks to potential receptors to the groundwater	Potential risk to receptors from the water table aquifer is posed by current conditions at the site if the groundwater is used as a potable supply. However, potable use of the groundwater is unlikely (although no measures would be in place to prevent it).	Potential risk to receptors from the water table aquifer is posed by current conditions at the site if groundwater is used as potable water supply. However, potable use of the groundwater is unlikely and institutional controls would prevent potable use. MNA will detect any change in current groundwater concentrations and determine how well the treatability study response actions are working.
<b>Compliance with ARARs</b>		
Chemical-Specific ARARs	Currently groundwater exceeds drinking water ARARs (MCLs) and tap water RBCs for several metals and chlorinated VOCs. Risk to contaminated groundwater above the MCLs and PRGs remains.	Groundwater-use restrictions would prevent groundwater use as water supply, therefore, potential drinking water ARARs would be met. MNA would track changes in groundwater quality.
Action-Specific ARARs	Not applicable.	Meets all action-specific ARARs.
Location-Specific ARARs	Not applicable.	Meets all action-specific ARARs.
<b>Long-Term Effectiveness and Permanence</b>		
Groundwater	Response actions would most likely still result in improved groundwater quality, but no monitoring would take place to measure effectiveness of treatability study. Possible risk posed by potable use of groundwater still exists. No permanent means to prevent future use of site in a manner that would result in unacceptable risk from groundwater.	Groundwater quality should improve as a result of the treatability studies. Institutional controls and MNA would be relied upon to track changes in groundwater contaminants.
Need for Five Year Review	Because of contaminated material (groundwater) remains onsite, five-year reviews would be required.	See Alternative 1.
<b>Reduction of Toxicity, Mobility, or Volume</b>		
Groundwater	Groundwater toxicity and contaminant reduction is expected to take place as a result of the response actions. However, no monitoring would take place to confirm reduction in contaminant concentrations.	Toxicity associated with contaminated media would reduce due to enhanced biodegradation and natural degradation of CVOCs. Volume reduction is also attained through enhanced biodegradation and natural degradation.
Type and Quantity of Residuals Remaining After Remediation	No treatment undertaken. Depending on the effectiveness of the treatability studies, contamination may remain after the post-injection monitoring period is over.	Depending on effectiveness of the treatability studies, contamination may remain after the post-injection monitoring period is over.
<b>Short-Term Effectiveness</b>		
Groundwater	Remedy implementation does not add to risk.	Remedy implementation does not add to risk.
Time Until Action is Complete	Not applicable.	MNA monitoring will occur in May and September 2004 and annually as deemed necessary.
<b>Implementability</b>		
Ability to Construct and Operate	Not applicable.	No construction necessary. Operation would consist of LTM for MNA parameters to track contaminant degradation. Groundwater-use restrictions would require consent from base command.
Ease of Implementing Additional Action if Needed	Very easy to implement additional action.	Very easy to implement additional action.
Ability to Monitor Effectiveness	Easily monitored during five-year site reviews.	Easily monitored during five-year site reviews. MNA will also be used to evaluate the groundwater quality.
<b>Cost</b>		
Present-Worth	\$15,721	\$55,385

**Table 3**  
**Cost Estimates for One Round of Monitoring for 5-year Review under Alternative 1 or each round for Alternative 2**  
**SWMUs 2B, 2C, and 2E FS Addendum**  
**NAS Oceana**  
**Virginia Beach, VA**

Cost Item	Unit	Quantity	Unit Cost	Cost	Cost Estimate Reference
<b>Laboratory Costs</b>					
Analysis Selected VOCs	per sample	25	\$ 100.00	\$ 2,500.00	recent similar project
Alkalinity	per sample	20	\$ 17.00	\$ 340.00	recent similar project
Nitrate, Nitrite, Sulfate, Chloride	per sample	20	\$ 37.00	\$ 740.00	recent similar project
Volatile Fatty Acids	per sample	20	\$ 22.00	\$ 440.00	recent similar project
TOC	per sample	20	\$ 22.00	\$ 440.00	recent similar project
Ferrous Iron	per sample	20	\$ 55.00	\$ 1,100.00	recent similar project
Methane, Ethane, Ethene	per sample	20	\$ 115.00	\$ 2,300.00	recent similar project
Sulfide	per sample	20	\$ 35.00	\$ 700.00	recent similar project
Data Validation for Select Organics	per sample	25	\$30.00		
<b>Labor Costs</b>					
Sampling and Reporting Labor	per round	1	\$ 7,000.00	\$ 7,000.00	recent similar project
<b>Monitoring Subtotal</b>				<b>\$ 15,560.00</b>	
Contingency (20%)				\$ 3,112.00	
<b>MNA TOTAL</b>				<b>\$ 18,672.00</b>	

**Assumptions**

Wells sampled for MNA are the same wells currently being sampled as part of the post-treatability study monitoring program  
Analyses performed for MNA are the same analyses currently being conducted as part of the post-treatability study monitoring program.